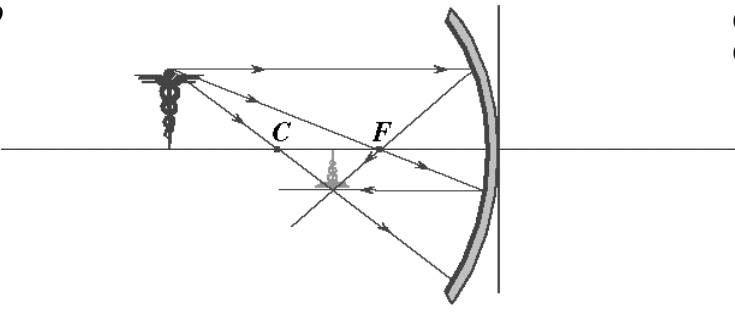
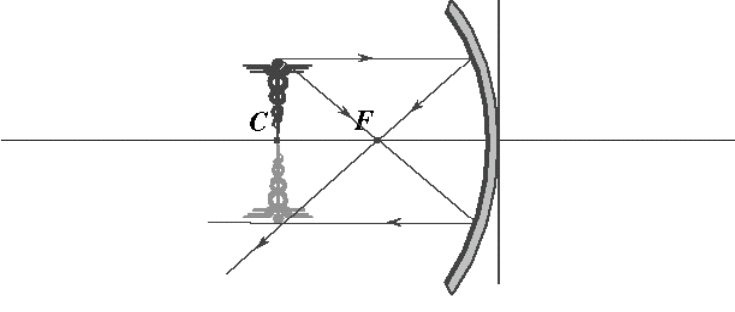
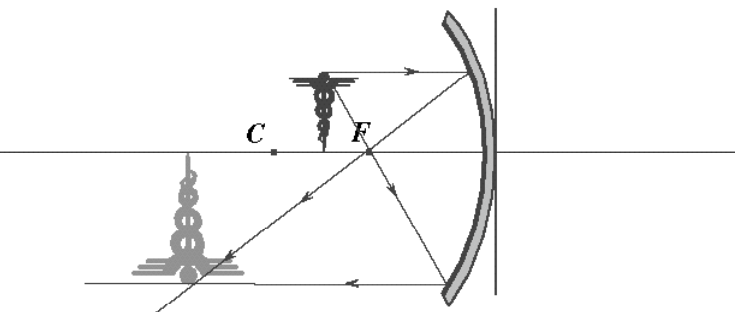
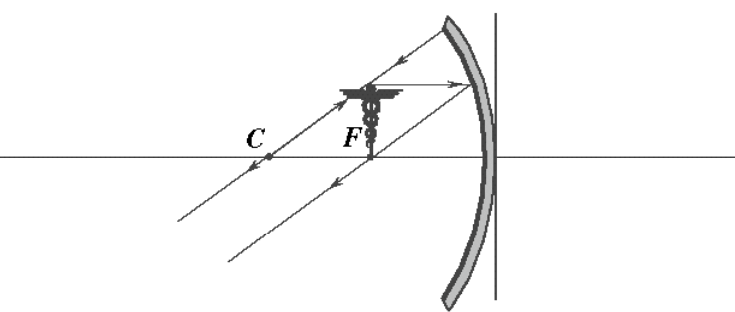
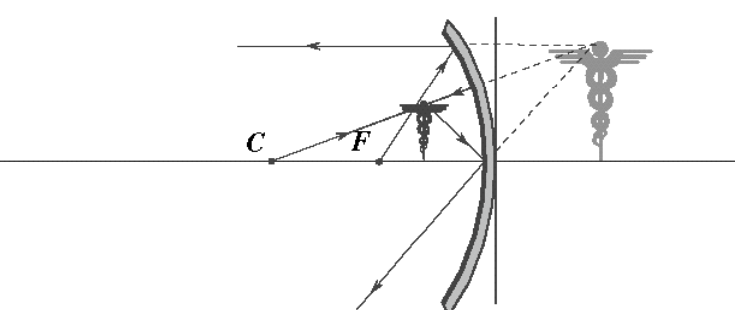
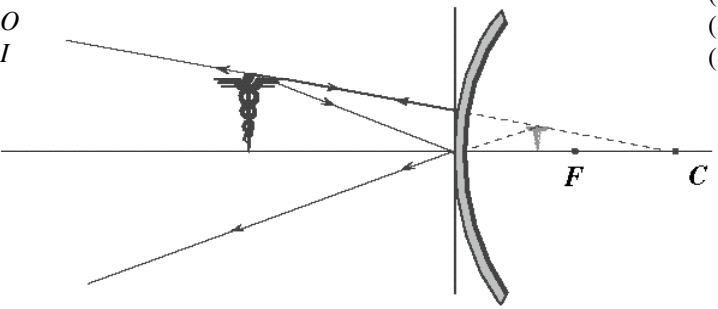


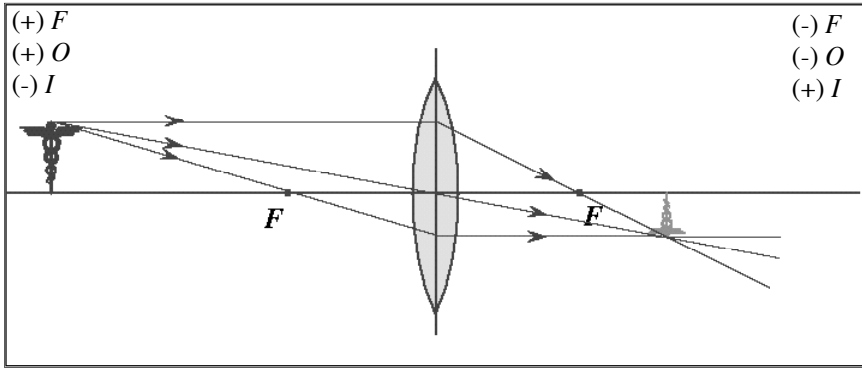
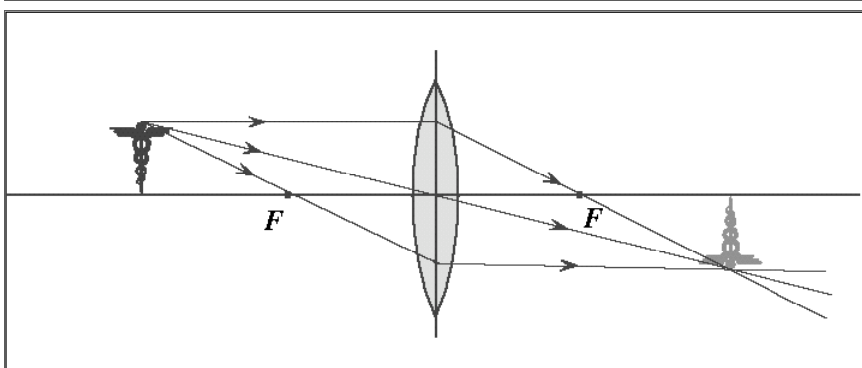
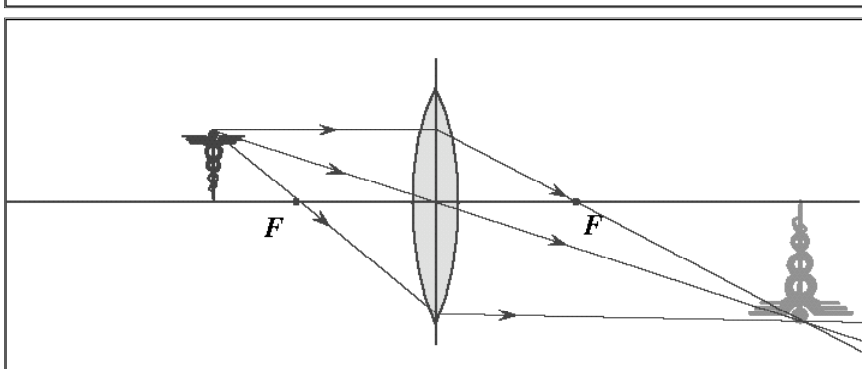
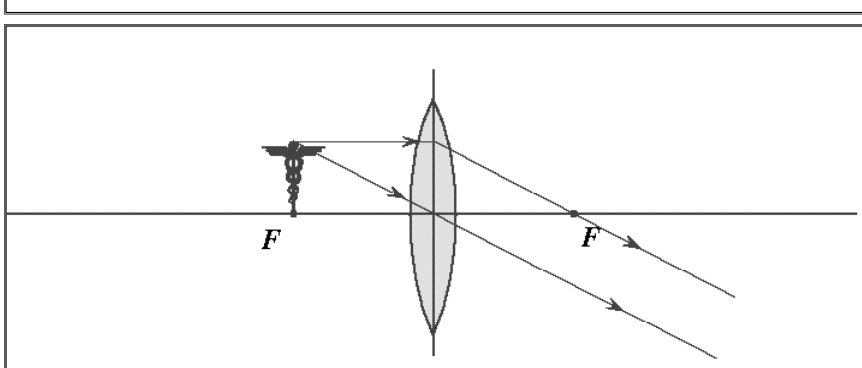
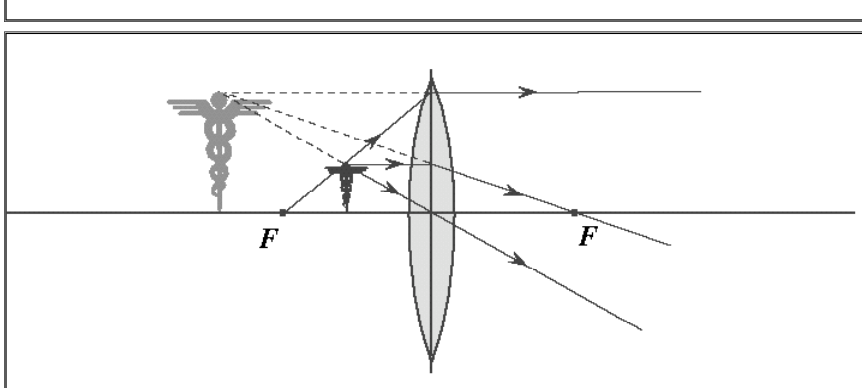
Concave Mirror

<p>(+) F (+) O (+) I</p> 	<p>(-) F (-) O (-) I</p> <p>($O > 2F$) examples $F=1, O=3$, then $f=3/2$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{3} + \frac{1}{I}$ <p>f is positive so image is real</p> $M = -\frac{I}{O} \rightarrow -\frac{3/2}{3} = -\frac{1}{2}$ <p>f is negative so image is inverted</p> <p>M is less than one so image is diminished</p>
	<p>($O = 2F$) examples $F=1, O=2$, then $f=2$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{2} + \frac{1}{I}$ <p>f is positive so image is real</p> $M = -\frac{I}{O} \rightarrow -\frac{2}{2} = -1$ <p>f is negative so image is inverted</p> <p>M is equal to one so image is same size</p>
	<p>($F < O < 2F$) examples $F=1, O=3/2$, then $f=3$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{3/2} + \frac{1}{I}$ <p>f is positive so image is real</p> $M = -\frac{I}{O} \rightarrow -\frac{3}{3/2} = -2$ <p>f is negative so image is inverted</p> <p>M is greater than one so image is enlarged</p>
	<p>($O = F$) examples $F=1, O=1$, then f is undefined</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{1} + \frac{1}{\infty}$
	<p>($O < F$) examples $F=1, O=1/2$, then $f=-1$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{1/2} + \frac{1}{I}$ <p>f is negative so image is virtual</p> $M = -\frac{I}{O} \rightarrow -\frac{-1}{1/2} = 2$ <p>f is positive so image is erect</p> <p>M is greater than one so image is enlarged</p>

Convex Mirror

<p>(+) F (+) O (+) I</p>  <p>(-) F (-) O (-) I</p>	<p>($F < 0$ [convex]) example: $F = -1$, $O = 2$, then $I = -2/3$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{-1} = \frac{1}{2} + \frac{1}{I}$ <p><i>I is negative so image is virtual</i></p> $M = -\frac{I}{O} \rightarrow -\frac{-2/3}{2} = 1/3$ <p><i>M is positive so image is erect</i> <i> M is less than one so image is diminished</i></p>
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Converging Lens

<p>(+) F (+) O (-) I</p> 	<p>(-) F (-) O (+) I</p> <p>($O > 2F$) example: $F = 1$, $O = 3$, then $I = 3/2$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{3} + \frac{1}{3/2}$ <p>f is positive so image is real $M = -\frac{I}{O} \rightarrow -\frac{3/2}{3} = -\frac{1}{2}$ f is negative so image is inverted M is less than one so image is diminished</p>
	<p>($O = 2F$) example: $F = 1$, $O = 2$, then $I = 2$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{2} + \frac{1}{2}$ <p>f is positive so image is real $M = -\frac{I}{O} \rightarrow -\frac{2}{2} = -1$ f is negative so image is inverted M is equal to one so image is same size</p>
	<p>($F < O < 2F$) example: $F = 1$, $O = 3/2$, then $I = 3$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{3/2} + \frac{1}{3}$ <p>f is positive so image is real $M = -\frac{I}{O} \rightarrow -\frac{3}{3/2} = -2$ f is negative so image is inverted M is greater than one so image is enlarged</p>
	<p>($O = F$) example: $F = 1$, $O = 1$, then $I = \text{undefined}$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{1} + \frac{1}{\infty}$
	<p>($O < F$) example: $F = 1$, $O = 1/2$, then $I = -1$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{1} = \frac{1}{1/2} + \frac{1}{-1}$ <p>f is negative so image is virtual $M = -\frac{I}{O} \rightarrow -\frac{-1}{1/2} = 2$ f is positive so image is erect M is greater than one so image is enlarged</p>

Diverging Lens

<p>(+) F (+) O (-) I</p>		<p>(-) F (-) O (+) I</p> <p>($F < 0$ [diverging]) example: $F = -1$, $O = 2$, then $I = -2/3$</p> $\frac{1}{F} = \frac{1}{O} + \frac{1}{I} \rightarrow \frac{1}{-1} = \frac{1}{2} + \frac{1}{I}$ <p><i>I is negative so image is virtual</i></p>
		$M = -\frac{I}{O} \rightarrow -\frac{-2/3}{2} = 1/3$ <p><i>I is positive so image is erect</i> <i> M is less than one so image is diminished</i></p>